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# Dissecting the architecture of prefrontal cortical circuits

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Western BrainsCAN
Transforming brain research.

Project**Summary**
KNOWLEDGE MOBILIZATION & IMPACT

# Dissecting the architecture of prefrontal cortical circuits

## Background

The prefrontal cortex is the major node of the brain network that brings about higher cognitive functions (such as planning, reasoning and problem solving). When your brain is performing cognitive tasks, neurons in the prefrontal cortex display activity that represents states of processing.

This cognitive activity in the prefrontal cortex is influenced by many neurochemicals produced in the brain. These are called neuromodulators. Research has already shown that these neuromodulators influence the output of individual neurons in the prefrontal cortex - neurochemicals such as dopamine, norepinephrine, serotonin and acetylcholine. Dysfunction in these neurochemical systems and their effects on the prefrontal cortex is a hallmark of many neuropsychiatric diseases, including schizophrenia and Alzheimer's disease.

## The Problem

Neurons receive inputs and generate outputs - these outputs are known as 'action potentials' or spikes. Currently, we can record the spiking activity of neurons in the prefrontal cortex during cognitive tasks. This spiking activity is the output of the cognitive processes happening within the prefrontal cortex.

Much research has been performed on the effects of neurochemicals on this spiking activity. However, little is known about subthreshold activity. Subthreshold activity represents the inputs to these neurons, which is transformed into the spiking output during cognition. We also know very little about how clinically important drugs affect this subthreshold activity within neurons. This kind of understanding is crucial to drug development.

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NHP Core

### Western Faculty, Group or Institution

Schulich School of Medicine & Dentistry, Department of Physiology & Pharmacology

### Keywords

Novel neuroscience/neuroimaging techniques

### Related

None

## The Project

In this project, we will develop a technique for recording and simultaneously manipulating this input activity with drugs in awake subjects engaged in cognitive tasks. Recording and modifying this input activity with neurochemicals is a difficult technical challenge.

We are constructing an electrode system that is capable of such recordings in the prefrontal cortex and a glass multipipette that will enable us to manipulate the activity of neurons with drugs simultaneously. This approach is imperative for a comprehensive understanding of how single neurons contribute to cognitive tasks, and how they are affected in neuropsychiatric diseases that disrupt neuromodulation within the brain.

## Western Researchers

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